Chester Morse Lake/Masonry Pool Reservoir Complex Temperature and Water Quality Modeling Project Description

The Chester Morse Lake/Masonry Pool Reservoir Complex is a major component of Seattle Public Utilities' (SPU) water supply system. The Cedar system supplies approximately 2/3 of the regional water supply for approximately 1.3 million people. The reservoir provides mutiple operational functions including supply storage, hydroelctric power generation, instream flow mangement, and limited flood control. The system is, however, potentially subject to temperature and turbidity conditions that could negatively impact drinking water quality, resident fish populations, and fish downstream of the dam (e.g., Chinook, coho, and sockeye salmon), and adfluvial bull trout and their prey speices (e.g., pygmy whitefish) in the reservoir proper, as well as in lower reaches of its tributary streams (e.g., access for spawning). Currently, reservoir operations are substantially reactive to observed conditions.

The reservoir complex supports populations of adfluvial bull trout, rainbow trout, pygmy whitefish, and shorthead sculpin. Currently, SPU staff are conducting studies to document the seasonal behavior of salmonids in the reservoir system based on observed horizontal and vertical distributions of the three, sympatric species. Bull trout are a federally listed species under the Endangered Species Act and are one of 83 species covered under the Habitat Conservation Plan for the Cedar River Watershed (CRW-HCP, April 2000) that sets forth a 50-year commitment for management of the aquatic and terrestrial resources in the Cedar River Municipal Watershed. The HCP contains both financial commitments and research/monitoring commitments for bull trout, rainbow trout, and pygmy whitefish, a major prey of bull trout in the reservoir system, as well as other commitments protecting both aquatic and forest habitats throughout the watershed.

Additionally, the near future development of land-based pumping facilities and modifications to existing facilities (i.e., Overflow Dike) will confer the potential for substantially greater amplitude and variability in timing of reservoir fill and drawdown regimes. This added capablility has the potential for significantly modifying what has been relatively consistent historic reservoir operation. The work covered under this MOA will provide SPU water managers with a set of tools to predict changing water quality conditions; guide finer adjustments to releases made to the river; and enable development of reservoir operating strategies to optimize reservoir and river water quality. It will also provide SPU biologists/managers with a tool to assist in the interpretation of environmental data related to fish ecology in the reservoir system, so as to better inform water managers of the potential effects of reservoir operation on listed bull trout and other resident species. The model will assist in informing discussions with permitting agencies responsible for reviewing plans for SPU's pump station and associated managment options.

The project will entail development and calibration of a state-of-the-art water quality computer model of the reservoir and associated major river systems, with the capability for application to a variety of water supply operation strategies. Also, this model will serve as a critical component of a bioenergetics (food web) model of the reservoir system being developed concurently by the University of Washington. In combination, these models will be used to better understand and explain behavior patterns currently being documented in ongoing studies of resident fish, as well as provide an essential tool to assist in the analysis and evaluation of both ecological and operational data from the reservoir system under various and/or changing operatinal scenarios in the future.

The modeling effort should have the capability to describe and predict reservoir conditions (i.e., temperature, sediment) under the current operating regime in which annual change in lake level ranges from approximately a high of 1,565 ft (Seatle datum) to a low drawdown depth of 1,540 ft. The model should also be designed to predict conditions in the reservoir outside this 'normal' fill and drawdown range (e.g., drawdown to 1,530 ft), which has been approached under 'drought' conditions in the recent past. Additional magnitude(s) of fill, and especially drawdown (1,502 ft), may be possible with future reservoir operations conferred by the land-based pumping plant and/or under extreme, future environmental conditions. The model should also have the capability to predict reservoir conditions under such diverse scenarios, if at all feasible. This work is intended to build upon the current temperature management system and associated tools.